# 4.0 REMEDIAL INVESTIGATION ACTIVITES

This section describes the field activities that were completed at the Moses Lake Maintenance Facility in fulfillment of the remedial investigation/feasibility study Work Plan (Golder, 2003).

The field investigation as described in this document involved 11 data collection activities. These tasks are intended to support the characterization of the Site hydrogeology and nature and extent of impacts to Site soil and groundwater, as well as the risk assessment. The data collection activities included the following:

1. Review of background and existing Site information;
2. Identification of subsurface utilities to avoid damage of the utilities during RI field activities and to assess the impact that the utility lines may have on Site groundwater flow;
3. Sampling of source area soils to characterize the nature of the chemical impacts;
4. Sampling of source area subsurface soils to define the vertical and lateral extent of the source and to investigate the potential for additional sources on the West Portion of the Site;
5. Installation of groundwater monitoring wells for investigation of groundwater quality up-gradient, down-gradient and in the petroleum hydrocarbon impacted central source area and to help determine Site groundwater flow characteristics;
6. Groundwater sampling at temporary locations associated with the West Portion of the Site to investigate impacts to groundwater and the potential for other sources;
7. Groundwater quality sampling of selected existing monitoring wells in the UST closure remediation area on the east side of the Site and new monitoring wells installed during the RI;
8. Groundwater level monitoring in Site wells;
9. Hydraulic and physical aquifer testing of new monitoring wells installed during the RI and selected existing wells on the east side of the Site;
10. Performance of a simplified terrestrial ecological evaluation for the Site; and,
11. Geodetic control and surveying of existing and new Phase 1 RI monitoring wells.

## 4.1 Background and Existing Information Review

### 4.1.1 Topographic Map Review

Golder reviewed the historic United States Geological Survey 1956 and 1978 7.5 minute quadrangle topographic maps covering the Site and surrounding vicinity. Copies of these maps are included in Appendix D. The 1978 map shows very little change from the current topographic map and notes an oil tank next to the former Basin Oil Company property east of the Site. The 1956 map shows more detailed topography and highlights the location of the Site on the toe of a northwest facing slope. The oil tank is also noted on this 1956 map. In addition, the mall south of the Site and the northern continuation of Block Street to Broadway Avenue are not shown (since they did not exist when the 1956 map was published).

4.1.2 Fire Insurance Maps

Golder contracted Environmental Data Resources, Inc. (EDR) to identify historical fire insurance maps for the established maintenance facility. EDR maintains the largest and most complete archive of fire insurance mapping. No historical maps were located for the facility, which indicates that the facility has not been used as commercial property in the past.

4.1.3 Environmental Database Search

An environmental database search was conducted by Environmental Data Resources, Inc. (EDR) in accordance with ASTM E 1527 – 00 "Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessments," which included a search of 27 federal, state and local databases. Any sites with the same zip code as the Site are flagged and if they fall within the ASTM-designated search distance from the Site, are located on a base map. Details of the search results and search distances from the Site for the various databases are shown on the Map Findings Summary in the EDR report, which is included as Appendix E.

Results of the search indicated that the Site was listed in the following databases:

- RCRIS-SQG (federal Resource Conservation and Recovery Information – Small Quantity Generator)
- FINDS (federal Facility Index System)
- UST (state Underground Storage Tank list)
- LUST (state Leaking Underground Storage Tank list)
- CSCSL (state Confirmed and Suspected Contaminated Sites list),
- WA ICR (Washington Independent Cleanup Record)
- CERC-NFRAP (CERCLIS No Further Action Planned)

The Site is recorded on the federal RCRIS and FINDS databases since small quantities of hazardous chemicals are stored at the Site and since it is the City Maintenance Facility. The state listings reflect the confirmation of petroleum impacted soils and groundwater on the East Portion of the Site and removal and remediation activities associated with these impacts.

The database search also highlighted the following sites that are located hydraulically up-gradient from the maintenance facility. The approximate locations of the sites are shown on the overview and detailed radius maps presented with the EDR report in Appendix E.

- Basin Oil Company at 901 E Wheeler Road (a RCRIS-SQG site) located within 0.125 miles from the Site;
- Grant County Hospital District 1 at 801 E Wheeler Road (a RCRIS-SQG, FINDS and UST site) located within 0.125 miles from the Site;
- Swartz Electric at 934 E Wheeler Road (a UST site) located within 0.125 and 0.25 miles from the Site;
- East Columbia Basin Irrigation District at 514 Buchanan Street (a RCRIS-SQG, UST, LUST and WA ICR site) located within 0.125 and 0.25 miles from the Site;

- Moses Lake SOC at 418 N Clover Drive (a UST and LUST site) located within 0.25 and 0.5 miles from the Site; and,
- International Titanium at 1320 Road 3 NE (a RCRIS-SQG, FINDS, CSCSL and CERC-NFRAP site) located within 0.25 and 0.5 miles from the Site.

In terms of environmental concern, the following sites have had or still have the highest potential to impact groundwater at the Site:

- The site of the previous Basin Oil Company at 901 E Wheeler Road (a RCRIS-SQG site) is immediately east (about 150 feet) of the Site. According to City personnel, a leaking diesel UST was found on the site that was associated with diesel contamination of soils on the east side of the unnamed road that runs along the east side of the maintenance facility Site (Figure 1-2). When the City improved this road, they encountered diesel impacted soils within the ditch along the east side of the road.
- The East Columbia Basin Irrigation District at 514 Buchanan Street (a RCRIS-SQG, UST, LUST and WA ICR site) is located within 300 feet up-gradient of the Site (Figure 1-3). The EDR search results indicate that a leaking underground storage tank containing petroleum products had contaminated soils at the site and was removed in late 1993. A cleanup report was filed with Ecology in February 1994. In addition, three USTs containing leaded and unleaded gasoline were removed from the site.

In addition to known sites, the EDR database search identified 39 orphan sites that were insufficiently addressed to be plotted on the base map but had the same zip code as the maintenance facility Site.

### 4.1.4 Site Reconnaissance

A visual reconnaissance of the Site and nearby vicinity was conducted on March 7, 2003, prior to initiating drilling and sampling activities. Additional reconnaissance of the adjacent properties was completed during the field activities. During the reconnaissance, the Site was checked for previously unidentified physical evidence of potentially hazardous substances or petroleum products that may impact the subject property. At this time a Golder scientist observed the condition of the Site and adjacent properties, making note of geologic, topographic, and hydrologic features. While observing adjacent properties trespass laws were respected. Photographic documentation is provided in Appendix D.

Evidence of potential Site contamination was noted during the reconnaissance of the property, including:

- Evidence of storage or use of hazardous chemicals;
- Evidence of aboveground and underground fuel storage tanks;
- Evidence of surface leaks or spills of petroleum products or other hazardous materials;
- Evidence of hazardous material or waste storage/disposal areas including sumps, floor drains; and
- Hydraulic systems and electrical transformers or capacitors potentially containing PCBs.

*4.1.4.1 Eastern Investigation Area*

The eastern investigation area (Figure 1-2) is composed of the following (referenced photographs are provided in Appendix D):

- A maintenance shop on the east side of the property (Photograph 1);
- A Cascade Natural Gas building on the southeast corner of the property (Photograph 1);
- A parks department shop building south of the maintenance shop (Photograph 2);
- A secure chemical storage area south of the maintenance shop (Photograph 3); and,
- An office building and asphalt parking area on the north central portion of the property (Photograph 4).

The maintenance shop on the East Portion of the site (Figure 1-2) is divided into two areas: a concrete floored shop area on the east side (Photograph 5) and a covered gravel parking area on the west side (Photograph 6).

There is concrete floored wash rack on the south side of the shop area (Photograph 7) used to wash vehicles and parts. Communication with City personnel and review of Site plans (Figure 1-2) indicates that drainage from the wash rack flows west from the drain to just west of existing monitoring well MW-11 (Photograph 7) prior to the drain line turning north. The drain line flows through an oil-water separator located on the north side of Penn Street prior to flowing west along Penn Street (Figure 1-2). Four floor drains were also noted in the concrete floored shop area on the east side of the site. One of the drains is located about 10 feet northeast of existing monitoring well MW-05. It is assumed from the Site plan (Figure 1-2) that water that collects with the floor drains, flows in a northwest direction and joins the flow from the wash rack drain prior to flowing into the oil-water separator on the north side of Penn Street.

Activities that occur within the shop area include vehicle repair and maintenance involving use of hydraulic lifts. Tools and fluids (antifreeze, motor oils, lubricants, solvents and paints) associated with these activities were noted within the building. No evidence of improper storage of chemicals nor surface leaks or spills that would pose an environmental risk was noted while conducting the RI.

*4.1.4.2 Central Investigation Area*

The main features of the central investigation area (Figure 1-2) include:

- A material stockpile area (including pieces of pipe, fencing, small storage sheds, sand and bricks) (Photograph 8);
- A concrete lined sweeper wash pit (Photograph 8);
- Storage of tires, paint, toluene drums and oil drums along the fence line;
- A large gravel stockpile on the southwest portion of the facility (Figure 1-2 and Photograph 8); and,
- An office building and warehouse area located at 717 E Penn Street (Photograph 9).

The existing sweeper pit (Photograph 8) is used to wash down vehicles that are used by the City to clean streets. The sweeper pit drains into the oil-water separator located within the northwestern

corner of the established maintenance facility area (just south of the police impound lot and east of the central fence line). From the oil-water separator (Figure 2-1), the drain flows northwards into the storm drain line that runs in a westerly direction along Penn Street.

Communication with City personnel indicates that there was a historic sweeper pit located immediately south and in the vicinity of the existing sweeper pit. The previous sweeper pit was constructed of drain gravel within an unlined excavation. Vehicles drove on to the gravel and were cleaned out by washing the waste materials into the gravel and allowing the wash water to infiltrate. Since the previous pit was not lined, wash water infiltrated into the ground.

During the March 7, 2003 Site visit, the office at 717 East Penn Street was being used to store geotechnical equipment and building maintenance equipment (Photograph 9). Chemicals including paints, solvents, herbicides, pesticides, and chlorodifluromethane were noted in small containers. No floor drains were noted in the building, or any evidence of improper storage of chemicals nor surface leaks or spills that would pose an environmental risk.

City personnel said there is a shallow groundwater collection system beneath the Central Portion of the site that comprises a 6-inch perforated and corrugated pipe bedded with drain gravel. Although there are no site plans showing the locations of the drains, the collection system is believed to convey groundwater west into the storm drain that runs north about 40 feet west of the sweeper pit (Figure 2-1). This storm drain runs through an oil-water separator located within the northwest corner of the established maintenance facility area (just south of the police impound lot and east of the central fence line) prior to flowing northwards into the storm drain line that runs west along Penn Street (Figure 2-1).

The ground surface over the central investigation area is bare except for the southwestern portion to the west of the fence line, which is covered in asphalt.

#### *4.1.4.3 Western Investigation Area*

The main features of the western investigation area (Figure 1-2) include:

- A concrete floored and metal sided office and warehouse building on the northwest (Photograph 10);
- A concrete floored, cinder block storage room and warehouse building on the southwest (Photograph 11);
- A concrete floored and metal sided warehouse building on the southeast (Photograph 12); and,
- A catch basin equipped with a grate cover on the west-central side of the area (Photograph 13).

During the March 7, 2003 site visit: the northwestern warehouse was being used to store a road marking vehicle and sewer tank trailer (Photograph 10); the southwestern warehouse building was being used by the City to store pipe, rope, metal, light bulbs, lawn mowers and office equipment (Photograph 11); and, the southeastern warehouse was being used to store two snow plow trucks, a de-icing truck, a scraper and motor home (Photograph 12). No floor drains were noted in any of the buildings, or any evidence of improper storage of chemicals nor surface leaks or spills that would pose an environmental risk.

Based on communication with City personnel, there is also a shallow groundwater collection system beneath ground surface west of the established maintenance facility area and central fence line (which includes portions of both the central and western investigation areas shown in Figure 1-2). The collection system comprises a 6-inch perforated and corrugated pipe bedded within drain gravel. Although there are no plans, the City (based on communication with the previous owner) indicated that the lines are likely to run north and south, conveying groundwater into the Central Portion of the site and then westwards into a catch basin. The approximate locations of the lines and the catch basin (which is covered by an open grill as shown in Photograph 13) are shown on Figure 2-1. The City believes that the water flows from the catch basin in a northerly direction into the storm drain located at the southeastern corner of Penn and Block Streets (Figure 2-1).

All but the northeast and southwest corners of the area are surfaced with asphalt.

*4.1.4.4 Adjacent Land*

Figure 1-3 presents a schematic of the land and properties surrounding the Site. This schematic was prepared based on observations made on March 26, 2003 The following paragraphs describe the land and properties surrounding the Site, noting any conditions that may pose an environmental risk. Photographs supporting the descriptions are provided in Appendix D.

The Site is bounded on the north by Penn Street. The land immediately north of Penn Street and the Eastern and Central Portions of the Site is owned by the City of Moses Lake and has been partially filled for a distance of about 100 feet north of Penn Street to form a level gravel surfaced area, now used for parking vehicles (Figure 1-3). The land north of the fill area is undeveloped land, currently owned by Desert Investment Corporation and previously owned by the Milwaukee Railroad Company. The land is low-lying land and has a small surface water drainage flowing southwest. The drainage was originally constructed by the Milwaukee Railroad as an interception drainage ditch and is sometimes referred to as the Milwaukee Drain. Approximately 200 feet north of the northeast corner of Penn and Block Streets, the drainage flows into a storm drain (Photograph 14). Based on communication with City personnel, the storm drain runs west along the south side of Penn Street and then turns southwards, and runs south beneath Wheeler Road and beneath the Safeway parking lot (Figure 1-3).

The land north of Penn Street and the West Portion of the Site comprises commercial and light industrial buildings including 706 Penn Street, which is a concrete block building currently under repair and for sale, plus an automobile storage facility east of 706 Penn Street. A frame and axle shop is on the property northwest of the Site.

The Site is bounded on the east by a gravel road running north-south between Wheeler Road and Penn Street. The land northeast of the Site is currently undeveloped (Figure 1-3). The land east of the Site is divided into two pieces. The northern piece was owned by Basin Oil. The southern piece comprises a warehouse, loading bay and office used by USF Reddaway and American Linen. Columbia Paint and Coatings is in Lovins Business Park, on Wheeler Road, just east of the loading bay. In terms of potential contamination sources, evidence of previous above ground and underground storage tanks and fuel conveyance piping was noted at the previous Basin Oil facility immediately east and up-gradient of the Site (Photograph 15).

The south of the Site is bounded by Wheeler Road, a busy road that connects the eastern side of the City to the downtown area. The Samaritan Hospital is located south of Wheeler Road and the existing maintenance facility. Low-lying undeveloped land is located to the south of Wheeler Road and the West Portion of the Site. A Safeway store is located on the land south of Wheeler Road and

the southwest of the Site. The East Columbia Irrigation Project facility and residential land is south of Wheeler Road and southeast of the Site. In terms of potential contamination sources, a number of large aboveground storage tanks were noted at the East Columbia Irrigation Project facility that is immediately southeast and up-gradient of the Site (Photograph 16).

The west of the Site is bounded by Block Street. Commercial and light industrial buildings including automobile repair, storage and towing facilities are on the west side of Block Street.

4.1.5 Historical Aerial Photograph Review

Golder reviewed the following low altitude aerial photographs:

- 1962 Black and White Photograph of the 5 corners (B-41-5-82)
- 1974 Black and White Photograph of the intersection between Wheeler Road and SR17
- 1996 USGS Black and White Photograph of the 5 corners

Copies of the photographs are included in Appendix D.

1962 Black and White Photograph of the 5 corners (B-41-5-82)

The Site appears similar to current conditions with the administration building, maintenance shop and Park's building to the south of the maintenance shop in place and a gravel storage area on the south side of the Site. The covered gravel garage on the west side of the maintenance shop has not yet been constructed. A vegetated area runs north-south along the boundary between the currently established maintenance facility and the property purchased by the City in 2001. There also appears to be a vegetated drainage that runs in a northwest-southeast direction across the property purchased by the City in 2001, from the western property line, north of the warehouse on the southwest of the property, to Wheeler Road at the western boundary of the established maintenance facility property. The drainage appears to run beneath Wheeler Road and into the wetland to the south of the Site. This is most likely the drainage referred to by City personnel that is a continuation of the Milwaukee Drain prior to the drainage being routed into the storm drain system. Buildings on the western property include the warehouse on the southwest and a building in the existing concrete block building on the northeast of the property.

The area surrounding the Site is similar to current conditions with a few exceptions. There is a ball park in the location of the current cinema building located about 0.25 miles northwest of the Site. The mall (where Safeway is currently located) and the parking lot south of the Site have not yet been developed. The area north of the Site, which has been filled and is currently used by the City as a parking area, is vegetated, undeveloped land. There are buildings on the site of the former Basin Oil Company property east of the Site. The Lovins Business Park has not yet been constructed on Wheeler Road. The residential area to the southeast of the Site, on the south side of Wheeler Road, is less developed than at present.

1974 Black and White Photograph of the intersection between Wheeler Road and SR17

This photograph shows the intersection between Wheeler Road and SR17 and the land to the north of the intersection. The Site is not shown in the photograph. In comparison to the 1962 photograph, the only change to this intersection appears to be some additional commercial development on the north side of Wheeler Road, just west of the SR17 intersection.

1996 USGS Black and White Photograph of the 5 corners

The Site and surrounding area appear very similar to current conditions with the exception that the cinema, located about 0.25 miles northwest of the Site has not yet been constructed. The wetlands are apparent to the north and south of the Site. The drainage channel to the north of the site is apparent, running along the east side of the wetland area. There are no buildings in the vicinity of the Basin Oil Company property immediately to the east of the Site.

### 4.2 Area Groundwater Evaluation

Washington State water well records were searched to identify groundwater supply wells and evaluate groundwater usage in the area of the site. The search identified all water wells in Ecology's records in the SW ¼ of the SE ¼ of Section 14, SE ¼ of the SW ¼ of Section 14, NW ¼ of the NE ¼ of Section 23, NE ¼ of the NW ¼ of Section 23, 19 North, Range 28 East, Willamette Meridian. The search identified numerous resource protection wells, the majority of which were related to the Site. Water supply wells were identified in the following three locations within the search area.

- United Concrete Pipe Corporation water well (well log ID 173768) is located in the NW ¼ Section of the NE ¼ Section of Section 14 (no street address is available). The well is approximately 0.4 miles hydraulically down-gradient of the Site, based on the direction of groundwater flow on the Site. Well log records maintained by Ecology (see Appendix A) identify the depth of this well as 47 ft bgs. The wetland area on the north side of Penn Street lies between the Site and the water well location.
- City of Moses Lake Water supply wells (well log IDs 164496, 164497 and 164491) are located at 321 South Balsam approximately 0.4 miles hydraulically cross-gradient to the Site based on the direction of groundwater flow on the Site. Well log records maintained by Ecology (see Appendix A) identify the depth of the well as 950 ft bgs.
- James B Thoren water well (well log ID 168437) is located at 1003 South Ash over 0.6 miles hydraulically cross-gradient to the Site based on the direction of groundwater flow on the Site. Well log records maintained by Ecology (see Appendix A) identify the depth of this well as 69 ft bgs.

The search results and water supply well logs are provided in Appendix A. Based on the nature and extent of impacts defined by the RI, the above listed water supply wells are not at risk of being impacted from contaminated Site soils.

### 4.3 Utility Locate

Prior to invasive work onsite, Golder contracted with utility locator services to mark all known utilities in the sampling areas. Utilities including electrical power, water, sewage, natural gas and phone lines were marked. Golder field staff reviewed the marked utilities and confirmed the locations of the utilities with City personnel prior to confirming the locations of the subsurface investigation sites. All excavating and drilling activities were conducted in a manner that avoided disrupting these underground utilities.

### 4.4 Site Survey

A Site survey was completed between April 1 and 2, 2003 by the City of Moses Lake Engineering Department after RI field activities were complete. The City located all test pit, GeoProbe and monitoring well locations using a GPS with a horizontal accuracy of 0.02 feet. In addition, the

ground surface and top of casing (the measuring point for water level readings) for the existing and new monitoring wells were surveyed using a total station to an accuracy of 0.01 foot. Due to the modifications made to the monitoring well monuments at MW-15 through MW-18, the wells were re-surveyed on May 13, 2003. All RI sample locations were plotted on the Site Plan and are presented on Figure 3-2. A copy of the survey points is provided in Appendix F. Sample locations GP-24 through GP-30 were measured in the field and transferred to the Site Plan and were not surveyed.

### 4.5 Soil and Groundwater Sampling

The RI field sampling was conducted by Golder between March 7 and December 9, 2003. The following sections describe the methods and sampling activities conducted during the RI. Tables 4-1 through 4-9 provide an overview of soil and groundwater sampling in each sampling zone. A full description of all sampling methods, QA procedures, etc. is described in the SAP and QAPP, Appendices A and B of the approved RIFS Work Plan.

To understand conditions on-site, we divided the site into three sampling zones: the eastern investigation area; the central investigation area and the western investigation area (Figure 1-2). The three zones are described briefly below:

- The East Portion of the Site, in the vicinity of the maintenance shop, is the location of previous petroleum hydrocarbon soil and groundwater remediation activities associated with UST closures;
- The Central Portion of the Site is where oil impacted soils were encountered during a 2002 geotechnical/environmental investigation (Golder, 2002); and,
- The West Portion of the Site was purchased by the City in 2001 and has been used mainly for metal fabrication. There is a potential that releases of petroleum hydrocarbons or other chemicals may have occurred at the site.

Four subsurface investigation techniques were employed: test pitting in the eastern and central investigation areas; drilling and installation of groundwater monitoring wells within the central investigation area; GeoProbe boring in the eastern, central and western investigation areas and two hand auger borings. The total number of samples, sample intervals, and frequency of analytical methods for samples vary for soils and groundwater collected in these zones. The surveyed locations for the investigation sites are shown in Figure 3-2.

The soil sampling program (test pit excavations, GeoProbe, well borings and hand auger borings) was subject to controls and strict QA protocols and procedures specified in the relevant technical procedures referenced in the Work Plan (Golder, 2003). These technical procedures include the following:

- TP 1.2-5 "Drilling, Sampling, and Logging Soils".
- TP 1.2-6 "Field Identification of Soil".
- TP 1.2-18 "Sampling Surface Soil for Chemical Analysis".
- TP 1.2-23 "Chain-of-Custody".

Drilling, installation, sampling and testing of the new groundwater monitoring wells, groundwater sampling of the existing groundwater monitoring wells and groundwater sampling of the GeoProbe borings within the western investigation area were subject to controls and strict QA protocols and

procedures specified in the relevant technical procedures referenced in the Work Plan (Golder, 2003). These technical procedures include the following:

- TP 1.2-12 "Monitoring Well Drilling and Installation".
- TP 1.2-20 "Collection of Groundwater Quality Samples".
- QP 11.1 "Calibration and Maintenance of Measuring and Test Equipment".
- TP 1.2-23 "Chain-of-Custody".
- TP 1.4-11 "Technical Procedure for Single Borehole Drawdown and Recovery Pump Test".

### 4.5.1 Test Pit Investigations

Six test pits (denoted as TP-01 through TP-06 on Figure 3-2) were excavated in the eastern and central investigation areas on March 18, 2003 using a backhoe. The test pit was initially excavated to about four feet below ground surface. The excavation was then entered by the onsite hydrogeologist and the soils logged and sampled from the walls and floor of the excavation using a clean stainless steel spoon. The excavation was then continued with samples logged and collected from the backhoe bucket. When all sampling activities were complete, the excavated soils were replaced in the hole and compacted in place.

The soil was visually evaluated and described on a field test pit log. Soil was carefully transferred from the excavation into appropriate sample containers to minimize volatilization. An aliquot of soil was immediately placed into a sample container for chemical analysis before any field screening or visual evaluation occurred. The depth interval for each sample was recorded. Soil samples were collected at discrete intervals, with additional samples collected based on lithology, visual identification of contamination, and field screening. Each sample depth interval was a discrete sample that varied from 6 inches to 1 foot in length depending on the volume of soil needed to fill the sample containers. Disturbance of soil samples and exposure to air was minimized to the extent practicable to prevent volatilization.

Soil samples were field-screened for visual indications of contamination and unusual odors. A Photoionization Detector (PID) was used to measure volatile organic compounds emanating from the soil being screened. The purpose of the field screening was to provide a relative indication of any potential contamination. Visibly contaminated soils were retained for laboratory analysis where the nature and degree of contamination was measured according to standard laboratory methods.

Soils were logged according to the Unified Soil Classification System (USCS). Soil samples were collected to define the geology and hydrogeology on-site and to characterize the soil impacts, if any. Samples taken for laboratory analyses were collected in 4-oz glass jars. Samples taken for on-site assessment of volatiles were collected in Ziploc bags and tested with a PID (equipped with a 10.6 eV lamp) about 5 minutes after sampling using headspace techniques. Test pit logs providing details of the soils encountered in each test pit are included in Appendix A.

All sampling equipment was decontaminated prior to the start of sampling activities and between each use. The sampling equipment was washed with a non-phosphate detergent (Alconox) solution using brushes to remove all visible dirt and grit. An organic free distilled/deionized water rinse was used to thoroughly remove all detergent solution followed by a rinse with purge-and-trap-grade methanol. The final rinse was organic free distilled/deionized water. A methanol-soaked towel was

used to remove material and the full-complement of decontamination procedures repeated when oil or other visible organic matter remained on the sampling equipment after the detergent/water wash.

Samples were collected in containers of appropriate volume and type as detailed in the QAPP (Golder, 2003). After filling, the containers were immediately sealed, labeled and placed in a cooler maintained at 4°C. Samples were transported to OnSite Environmental in Redmond, WA with chain-of-custody documentation in sufficient time to perform the requested analyses within the applicable holding times.

#### *4.5.1.1 Eastern Investigation Area Test Pits*

Three test pits (TP-01, TP-02 and TP-03) were excavated in the eastern investigation area in the area of the former diesel UST on the south side of the maintenance shop (Figure 3-2) to verify that impacted soils were excavated and removed during the UST closure. The test pits were excavated to depths ranging between 8 and 10 feet bgs. Samples were taken from TP-01, TP-02 and TP-03 from the soils in the vicinity of the water table to investigate the presence of petroleum hydrocarbons floating on the water table. Samples were also taken from the bottom of the test pit, at a depth corresponding to the soils below the previous diesel UST. The samples taken and laboratory analyses are summarized in Table 4-1. Equipment, field and trip blanks are not included on this table. An Ecology representative was present on-site for split sampling during the test pit excavations and collected a split sample in TP-03 at 9 ft bgs (Table 4-1). No evidence of soil impacts in the three eastern test pits were noted at the time of excavation.

#### *4.5.1.2 Central Investigation Area Test Pits*

Three test pits (TP-04, TP-05 and TP-06) were excavated in the waste oil source area (Figure 3-2) encountered during the 2002 Site geotechnical and environmental investigation (Golder, 2002) to characterize the nature of the contamination in this source area. Oil was noted in TP-04 soils at depths of 2.2, 3.0, 4.2 and 4.5 ft bgs and in TP-05 soils at depths of 3.0 and 3.9 ft bgs (Photograph 17). Perforated pipe bedded in rounded drain gravel was encountered at 4 ft bgs in TP-04 (on the north side of the test pit) and at 4.5 ft bgs in TP-06 (on the east side of the test pit) (Photograph 18). This is inferred to be the shallow groundwater drainage system that occurs within the central area of the site (Figure 2-1). The samples taken and laboratory analyses for the central area test pits are summarized in Table 4-2. Equipment, field and trip blanks are not included in this table. An Ecology representative was present on-site for split sampling during excavation of TP-04 and collected a split sample from TP-04 at between 2 to 3 ft bgs (Table 4-2).

### 4.5.2 GeoProbe and Hand Auger Investigations

A total of 30 GeoProbe borings (denoted as GP-01 through GP-30 on Figure 3-2) were completed within the eastern, central and western investigation areas on March 26 and 27, and May 1, 2003 using Cascade's direct push GeoProbe with a 4-foot long 1.5-inch ID sampler. The direct push technology involved the advancement of a sampler directly into the soil using hydraulic pressure and a hammer. A 1.5-inch ID steel sampling barrel fitted with clear PVC liners was driven into undisturbed soil to obtain individual soil samples from varying depths.

After being driven into the ground at 4-foot intervals, the steel sampling barrel was withdrawn and the liner extracted from the barrel sampler. The liner was cut length-wise and the exposed soil was field screened using the methods identified as those used for the test pit sampling in the preceding section. The soil was visually evaluated and described on a field boring log (Photograph 19). Borehole logs providing details of the soils encountered and the samples taken are included in Appendix A. The

GeoProbe soil samples collected for chemical analysis were selected based on field screening results. If field screening did not indicate the presence of petroleum hydrocarbons in any of the GeoProbe samples within the boring, the last sample collected from above the water table was submitted for analyses. Each sample depth interval was a discrete sample that will vary from 6 inches to 1-foot in length depending on the volume of soil needed to fill the sample containers. Disturbance of soil samples and exposure to air was minimized to the extent practical to prevent volatilization.

Two hand auger borings (denoted as HA-01 and HA-02 on Figure 3-2) were completed within the East Portion of the Site, May 2, 2003 using a 4-foot long hand auger with a 1.5-inch ID stainless steel sampler attachment. The auger was advanced by hand turning the tooling until soil moisture increased from dry/damp to moist. A stainless steel sampler was then attached to the rod and the sampler advance with a slide hammer. The sampler was removed and soil sampling continued as outline above for GeoProbe sampling. Borehole logs providing details of the soils encountered and the samples taken are included in Appendix A.

The GeoProbe and hand auger soil samples collected and submitted for chemical analyses were placed directly into 4-oz glass jars provided by the analytical laboratory and sealed with Teflon-lined lids. Soil was carefully transferred from the liners into appropriate sample containers to minimize volatilization. Any remaining soil material was placed in a Ziploc bag and sealed. The sample jars were labeled and placed in an ice chest for temporary storage at approximately 4°C until relinquished under chain of custody to OnSite Environmental in Redmond, WA with chain-of-custody documentation in sufficient time to perform the requested analyses within the applicable holding times.

All waste soils from the two day GeoProbe program were removed from the liners and placed into one labeled 5-gallon bucket for disposal once the contents of the soils have been determined.

#### *4.5.2.1 Eastern Investigation Area GeoProbe and Hand Auger Borings*

Three GeoProbe borings (GP-01, GP-02 and GP-03) were drilled in the eastern investigation area, down-gradient of the former waste oil UST (Figure 3-2) to verify that impacted soils were excavated and removed during the UST closure. Three additional GeoProbe (GP-24, GP-25 and GP-26) and two hand auger borings (HA-01 and HA-02) were advanced to below the water table at the southwest corner of the maintenance shop to delineate the extent of the petroleum hydrocarbons identified at MW-11. The East Portion GeoProbes were pushed to depths ranging between 7 and 8 feet bgs with refusal in GP-01 and GP-02 at 7 ft bgs on very dense, calcified Ringold Formation soils. Field screening did not indicate any petroleum hydrocarbon impacts to the soils and, as a result, the samples taken from the GeoProbes and hand auger borings were submitted for laboratory analysis represented the last sample collected from above the water table. Groundwater samples were collected from GP-24, GP-25, GP-26, HA-01 and HA-02. The groundwater samples collected from GP-25 and HA-02 were submitted for chemical analysis. Both the soil and groundwater samples submitted for chemical analyses are summarized in Table 4-3. Equipment, field and trip blanks are not included on this table.

#### *4.5.2.2 Central Investigation Area GeoProbe Borings*

Seventeen GeoProbe borings (GP-04 through GP-16, and GP-27 through GP-30) were drilled in the central investigation area (Figure 3-2) to characterize the soils and the nature and extent of the contamination in this source area. Field screening indicated the presence of petroleum hydrocarbon impacted soils in GP-08, GP-09 and GP-10 (Photograph 19 and Figure 3-2). Groundwater samples were collected from GP-27 and GP-28. The samples taken and laboratory analyses for the central

area GeoProbe borings are summarized in Table 4-4. Equipment, field and trip blanks are not included on this table.

*4.5.2.3 Western Investigation Area GeoProbe Borings*

Seven GeoProbe borings (GP-17 through GP-23) were drilled in the western investigation area (Figure 3-2) to characterize the soils and the nature and extent of the contamination, if any, in this previously uninvestigated area of the Site. Field screening did not indicate any petroleum hydrocarbon impacts to the soils and, as a result, the soil samples that were collected from GP-17 through GP-23 and submitted for laboratory analysis represented the last sample collected from above the water table. Groundwater samples were collected at each of the GeoProbe borings and the groundwater sample from GP-19, GP-22 and GP-23 were submitted for chemical analysis. The samples taken and laboratory analyses are summarized in Table 4-5. An Ecology representative was present on-site for split sampling and collected a split sample from GP-19 (Table 4-9). Equipment, field and trip blanks are not included on this table.

4.5.3 Monitoring Well Drilling, Installation and Development

Four groundwater monitoring wells were drilled and installed in the Central Portion of the Site (Figure 3-2) using a 4.25-inch ID, 8-inch OD hollow stem auger (HSA). The monitoring wells were located as follows; one well (MW-15) was located up-gradient of the waste oil impacted source area in the Central Portion of the Site, two wells (MW-17 and MW-18) were located down-gradient and the fourth well (MW-16) was within the source area. The purpose of the wells was to investigate potential chemical impacts to the groundwater.

Soil samples were collected continuously during drilling with 24-inch and 18-inch long by 2.5-inch ID split spoon samplers. The sampler was placed at the top of the desired sampling interval and advanced 24 or 18 inches beyond the cutting edge of the lead auger (or until refusal was encountered) by a 300-pound hammer with a 30-inch drop. After driving the sampler to depth, or refusal if encountered, the sampler was removed from the augers and broken down. The soil within the sampler was lithologically logged and field screened using the same general procedures outlined for the test pit and GeoProbe programs in Sections 4.6.1 and 4.6.2. The soil sampler was decontaminated prior to each use in accordance with the decontamination procedures outlined in Sections 4.6.1 and 4.6.2.

Samples were collected from MW-15 between 10 and 11.5 feet bgs and from MW-17 between 12.5 to 13 feet bgs within 6 inch long brass liners (see Table 2-3). These samples were sealed and submitted for physical analyses.

Field screening was used to determine which soil samples to submit for chemical analyses. These soil samples were initially submitted for analysis of total petroleum hydrocarbons by the State Approved NWTPH-HCID method. If petroleum hydrocarbons were detected by the NWTPH-HCID analysis the results were quantified by either NWTPH-Dx and/or NWTPH-Gx as appropriate. A separate soil sample was collected from each monitoring well boring from below the water table and submitted to the analytical laboratory for total organic carbon (TOC) analysis by EPA Method 9060. The TOC samples were collected and analyzed to support groundwater contaminate transport modeling, if it were to be required. TOC results are provided in Appendix G. The samples taken and laboratory analyses are summarized in Table 4-6. Quality Assurance (QA) samples (e.g. duplicates, blanks) are not included on this table.

After drilling each boring, Golder installed a monitoring well in conformance with Washington State well construction regulations (WAC 173-160). All wells were completed with 2-inch diameter, schedule-80 PVC 0.010-inch slot well screens and casing with O-ring seals between joints. The well screens were 10 feet long in MW-15, MW-16 and MW-17 and 8-feet long in MW-18. An 8-foot long well screen was installed in MW-18 due to difficulties with soil sloughing into the borehole during installation. The 8-foot long screen was fabricated by cutting two feet off a full length 10 foot long well screen. All of the well screens were installed to straddle the water table surface by approximately 2 feet. A bottom cap was attached to the end of each well screen, and then the casing/screen string were centered in the hole.

Well installation was conducted inside the auger flights. A filter pack was installed from at least 6 inches below the well screen to about 6 inches to 1 foot above the topmost slot on the screen. The filter pack materials consisted of 10/20 Colorado silica sand. The sand pack was surged (as part of well development) to settle the sand before placing 2 to 2.5 feet of bentonite seal. Details of the new wells completed for this RI study are presented on the borehole logs included in Appendix A. A summary of the well construction details is presented on Table 2-2. Following completion of the borehole and well, drill cuttings were placed in labeled 55-gallon drums. Well completion diagrams are presented on the boring logs provided in Appendix A.

After surging and placement of the bentonite seal, an additional one foot of concrete was used to create a slightly domed pad, constructed to divert water runoff away from the well. All monitoring wells were completed with nominal 8-inch diameter protective steel flush-mount well monuments. About 1 inch of clearance was maintained between the well cap and the monument lid to allow placement of a data logger, if needed. The wells were capped using a plastic slip cap.

Following installation of the groundwater monitoring wells, the monitoring wells were developed to produce representative formation water that is free of drilling fluids, cutting, or other materials potentially introduced during drilling and well construction. Development was performed through a combination of surging and groundwater purging using a submersible pump. Groundwater produced during purging was captured in labeled 55-gallon drums.

### 4.5.4 Groundwater Sampling

Golder collected groundwater samples during the initial RI study from:

- Five existing monitoring wells (MW-04, MW-05, MW-08, MW-10 and MW-11) and two open hole hand auger borings (HA-01 and HA-02) within the eastern investigation area (Figure 3-2);
- The four new monitoring wells (MW-15, MW-16, MW-17 and MW-18) within the central investigation area (Figure 3-2); and,
- Twelve temporary well screens installed within GeoProbe borings (GP-17 through GP-28) within the Site investigation area (Figure 3-2), seven of the samples were submitted for chemical analyses.

Groundwater samples were collected from five of the existing monitoring wells on the East Portion of the Site (MW-04, MW-05, MW-08, MW-10 and MW-11 on Figure 3-2). These wells were preferentially selected for sampling based on previous groundwater monitoring results and the current condition of the well. Based on information collected by Groundwater Technology (1994 and 1995), the existing groundwater monitoring well samples, which have contained petroleum hydrocarbons and/or lead, include MW-05, MW-06, MW-08, MW-10 and MW-11. At the time of the initial round

of groundwater level monitoring (March 17, 2003), Golder personnel noted petroleum hydrocarbon odors in MW-04 and not MW-06. As a result, groundwater was sampled from MW-04 instead of MW-06.

Golder collected additional groundwater samples during two subsequent sampling events conducted in association with the RI. The groundwater samples were specifically collected to resolve issues regarding the background concentration of arsenic in the shallow groundwater. A summary of the groundwater sampling activities are provided in Appendix A-1. Groundwater samples were collected from 10 Site monitoring wells including:

- Five existing monitoring wells (MW-02, MW-04, MW-05, MW-08, MW-10 and MW-11) within the East Portion of the Site and four new monitoring wells (MW-15, MW-16, MW-17 and MW-18) within the Central Portion of the Site (Figure 3-2).

MW-02 and MW-15 serve as the Site background wells.

Groundwater-sampling involved the following:

- Measurement of static water levels;
- Well purging using a Grundfos submersible pump for the monitoring wells and a peristaltic pump for the temporary locations (both with disposable tubing);
- Measurement of field parameters (pH, temperature, specific conductance, temperature, dissolved oxygen, and turbidity) during purging;
- Collection of all purge water was placed in labeled 55-gallon for temporary on-site storage prior to disposal; and,
- Collection of groundwater samples in appropriate containers.

The static water level was measured at each well prior to sampling. An electric well sounder was used for all manual water level measurements. The sounder was cleaned before and after each use by a process involving a detergent rinse, followed by an organic free distilled/deionized water rinse. The water level was measured from the elevation survey mark and was recorded to the nearest 0.01 feet. All recordings, dates, times and well designations are recorded on the Water Level Form included in Appendix A. A summary of the field parameter measurements, purge volumes and sample collection details are provided on the well purge forms and sample integrity data sheets in Appendix A.

During purging, field parameters were periodically measured. Purging was continued until the measured rate of change of the parameters was in accordance with TP-1.2-20 on consecutive readings. The instruments used in the field parameter measurements were field calibrated per the manufacturers' specifications and as described in the QAPP (Golder, 2003). Groundwater produced during purging was captured in labeled 55-gallon drums.

Samples were collected in bottles of appropriate volume and type, including preservatives as appropriate, as detailed in the QAPP. After filling, the bottles were immediately sealed, labeled and placed in a cooler maintained at 4° C. Samples were transported to the laboratory for analysis with chain-of-custody documentation in sufficient time to perform the requested analyses within the applicable holding times. The samples taken and laboratory analyses are summarized in Tables 4-7, 4-8 and 4-9. An Ecology representative was present on-site for split sampling and collected a split sample from MW-15 (Table 4-8).

Documentation for sampling included bottle labels, completion of Sample Integrity Data Sheets and chain-of-custody Records. The Sample Integrity Data Sheet was used to document groundwater sample collection information, as further described in the QAPP section of the approved RI/FS work plan (Golder, 2003).

### 4.5.5 Sampling of Soil and Water at the Western Catch Basin

During the RI activities, Golder personnel located the catch basin on the western central side of the western investigation area (Figure 2-1). Shallow groundwater that collects in the drainage system over the western investigation area (Figure 2-1) drains into this catch basin prior to flowing out to the sanitary sewer. To assess the general quality of the shallow groundwater as a whole and the sediment within the drainage system, water quality and sediment samples were taken from the catch basin. Sediment samples were collected from the catch basin on March 28, 2003. Water quality samples were collected from the catch basin on April 1, 2003.

Soil samples were taken from the bottom of the catch basin using a decontaminated stainless steel spade. Soil samples were collected in 4oz glass jars. The soil samples were submitted to OnSite for compositing and for analysis of NWTPH-HCID, semi-volatiles by EPA method 8270C, PCBs by 8082 and total RCRA metals. Water quality samples were taken by filling the appropriate containers directly from water contained in the catch basin. The water samples were submitted to OnSite for analysis of NWTPH-HCID, volatiles by EPA method 8260B and total RCRA metals.

## 4.6 Water Level Measurement and Product Removal at MW-11

Water levels were taken at all located, existing wells within the eastern investigation area and all new wells within the central investigation area on April 1, 2003 and again on September 26, 2003 according to the specifications of Golder Technical procedure TP-1.4-6 "Water Level Measurements." The water level measurements were collected as close to simultaneously as practicable in all wells in order to provide an accurate depiction of the water table. An electric well sounder was used for all manual water level measurements. The sounder was cleaned before and after each use by a process involving a detergent rinse, followed by an organic free distilled/deionized water rinse. The water level was measured from the elevation measuring point survey mark and was recorded to the nearest 0.01 feet. All recordings, dates, times and well designations are recorded on the Water Level Forms in Appendices A and A-1.

Floating product (petroleum) was discovered within the screened interval of MW-11 on April 1, 2003, while collecting groundwater measurements. The floating product was estimated to be approximately 6 inches thick.

While on site from September 25 through September 26, 2003, Golder personnel measured the floating product in MW11 using an interface probe and removed the floating product on three separate occasions, at 1500 on September 25, 2003 and at 0735 and 1600 on September 26, 2003. The thickness of the floating product in MW11 was measured at 2.4, 0.5 and 2.4 inches at these times respectively. After measurement, the product was pumped from the well.

## 4.7 Slug Testing

A series of three falling head and three rising head slug tests were conducted at MW-15 and MW-17 within the central investigation area on April 1, 2003. The tests were conducted in accordance with Golder technical procedure TP1.2-17 "Rising Head Slug Test". The falling head slug tests were performed by inserting a solid 6-foot long slug rod inside the well to displace the water in the well.

The rising head slug tests were performed by removing the slug rod from the well to displace the water in the well. The water level recovery after the slug is inserted (falling head test) and removed (rising head test) was monitored using automated pressure transducers and data loggers. The data was analyzed using the Hvorselv straight line method. The test analyses are included within Appendix B and the slug test results are summarized in Table 3-4.

### 4.8 Ecological Evaluation

The simplified terrestrial ecological evaluation was conducted in accordance with WAC 173-340-7492. This evaluation was initiated by obtaining a list of species for the site area protected under the Endangered Species Act, as well as the State list of Priority Habitats and Species. A site visit was conducted to observe species and habitat that could be affected if COCs (identified in Section 5) were to migrate off-site. With this information, a conceptual model was developed for ecological risk for an industrial site utilizing Table 749-2 of WAC 173-340-900. The model accounted for the nature and extent of contamination, exposure pathways, and possible receptors. The complete terrestrial ecological evaluation is provided in Appendix C.

### 4.9 Investigation Derived Wastes

Investigation derived waste (IDW) were generated on-site during boring, well development and well purging. All well development and purge water was contained in 55-gallon sealed drums and stored on the West Portion of the Site. The drums were labeled as outlined in the QAPP (Golder, 2003). Soil cuttings produced during drilling of the new monitoring wells were contained in 55-gallon sealed drums and stored on the West Portion of the Site. Waste soils produced during the GeoProbe program were contained within a sealed 5-gallon bucket and stored on the West Portion of the Site. All IDW containers were labeled as outlined in the QAPP (Golder, 2003).

Soil and groundwater quality data for the borings and wells will be used in the future to characterize the IDW prior to disposal. Additional IDW sampling may also be required prior to disposal at a licensed facility. Golder will work with the City of Moses Lake to manage IDW and will dispose of it during the remedial action, with Ecology approval.

### 4.10 Data Validation

All analytical data packages from each sample delivery group were validated by the detailed review and calculation validation processes described in *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review* (EPA 1999), and *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review* (EPA 2002). Data validation procedures were augmented in part by *"Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services"* (EPA, 1999). Data validation procedures were followed to ensure that the laboratory met all contractual requirements, all applicable reference method requirements, and the data quality objectives discussed in the RIFS Work Plan for the Moses Lake Facility and Appendix B (the Quality Assurance Project Plan), (Golder, 2003). The data review process provides information on analytical limitations of the data based on specific quality control (QC) criteria outlined in the referenced documents.

As part of data validation the split samples were collected by Ecology and analyzed at their Manchester Environmental Laboratory (Manchester) in Port Orchard, Washington. Ecology collected split samples from the following locations:

- Soil sampled from TP-03;

- Soil sampled from TP-04;
- Groundwater sampled from GeoProbe GP-19;
- Groundwater sampled from MW-15; and,
- Groundwater sampled from MW-11.

Split samples results are presented in the table notes on the appropriate analytical result tables presented and discussed in Section 5.

The copies of the annotated laboratory data reports are provided in Appendix G with the data validation report. Attachment 5 of the data validation report includes summary review tables of the sample holding times, a calculated comparison of duplicate and split samples and field blank samples.